

The Permian Oilfield Water Wave: Challenges and Opportunities

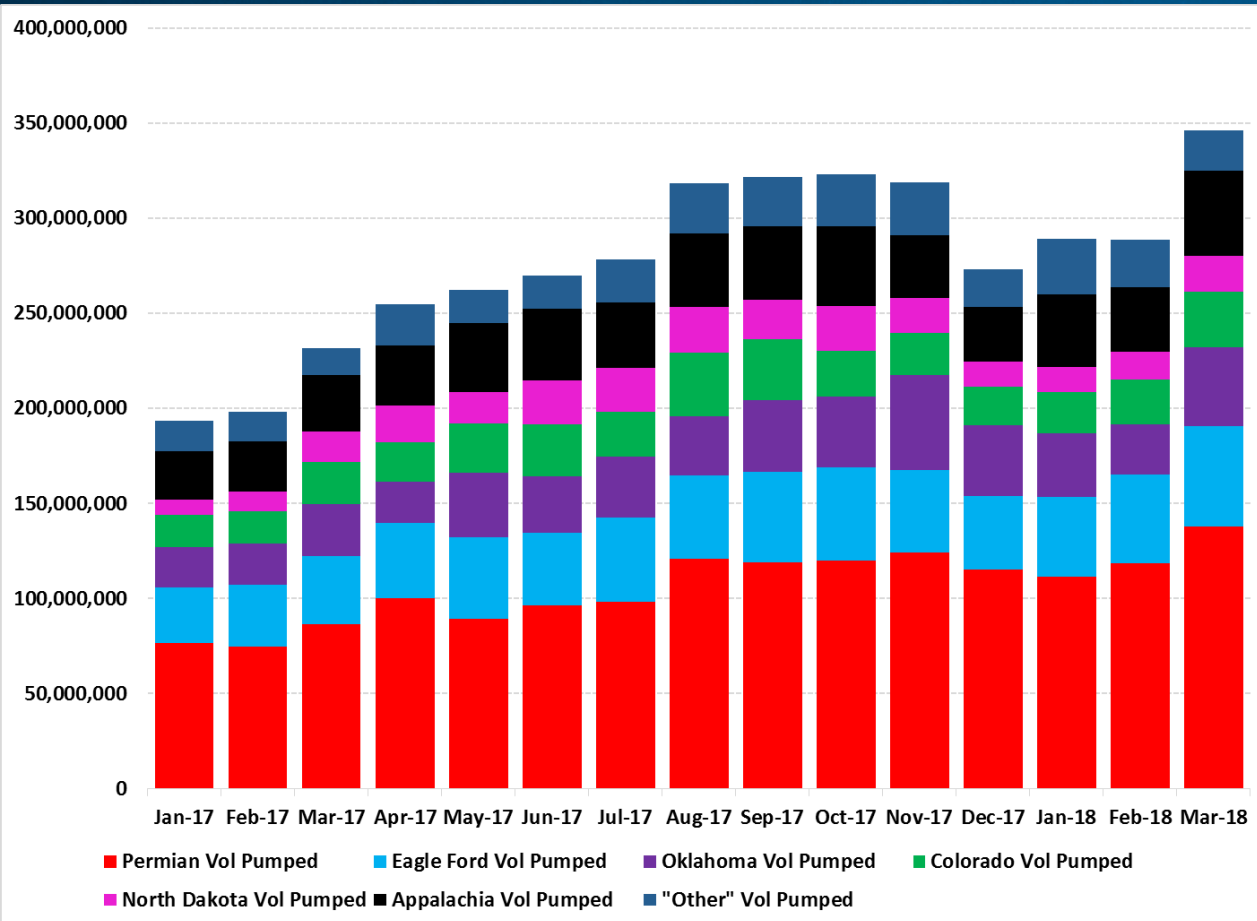


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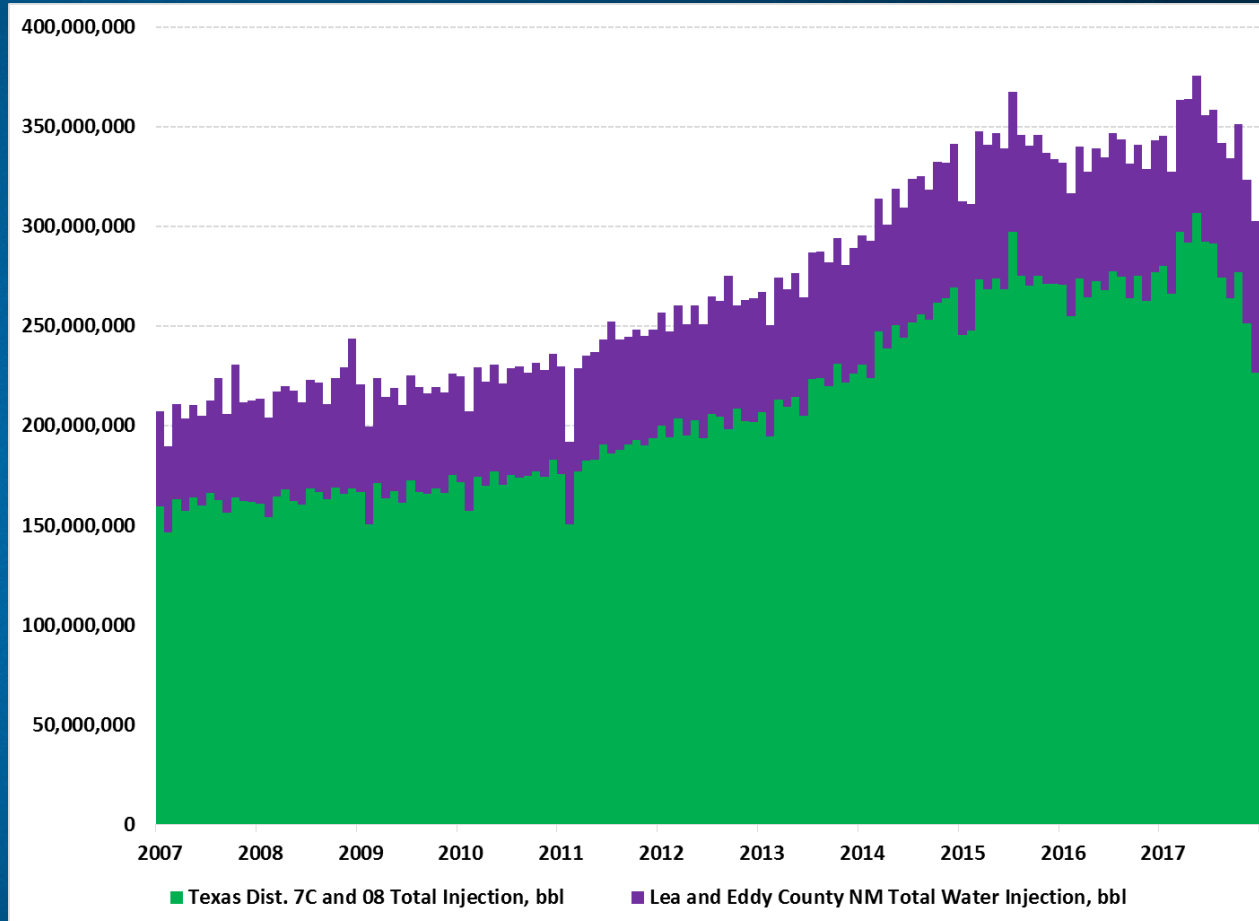
Permian Basin Oilfield Water: Supply & Demand

Frac Water Volumes Pumped



Source: FracFocus

Water Injection



Source: EIA, NM OCD, Texas RRC

Long-Lateral Permian Oil Well Inputs and Outputs Weigh ~405,000 metric tons

Per Well

Produced water:
Over 250,000 metric tons

Frac source water:
76,000 metric tons

Crude oil and liquids:
68,000 metric tons

Pipe, sand, misc. consumables:
Approx. 10,000 metric tons

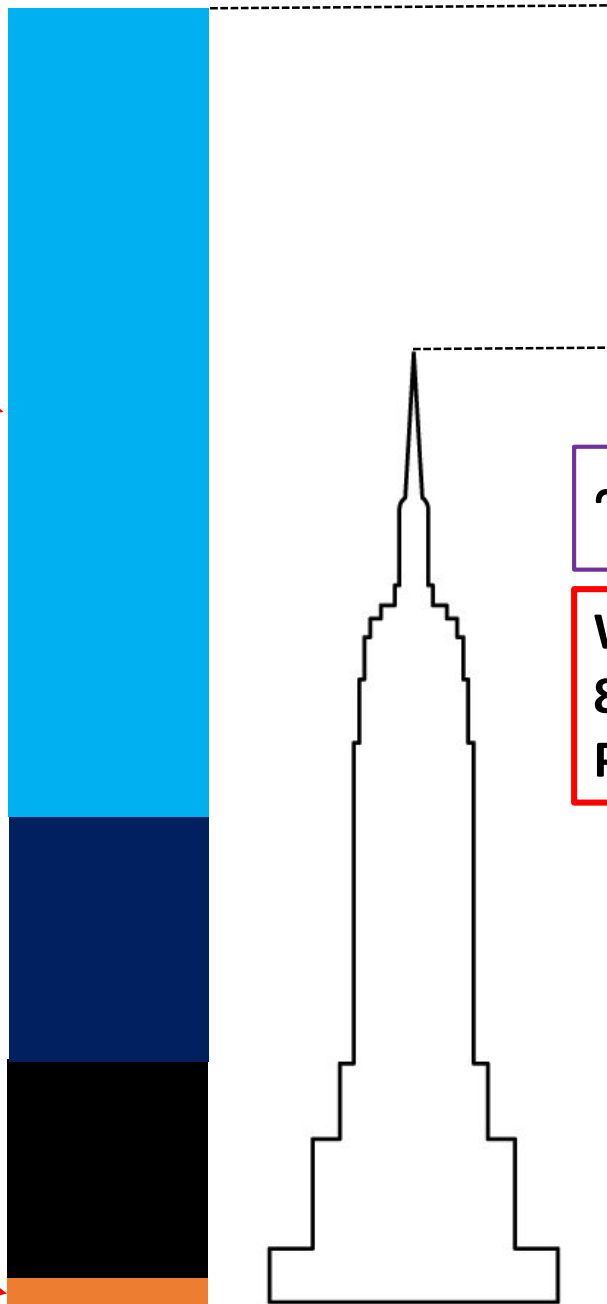
Empire State Building Weighs ~340,000 metric tons

~450 wells drilled per month

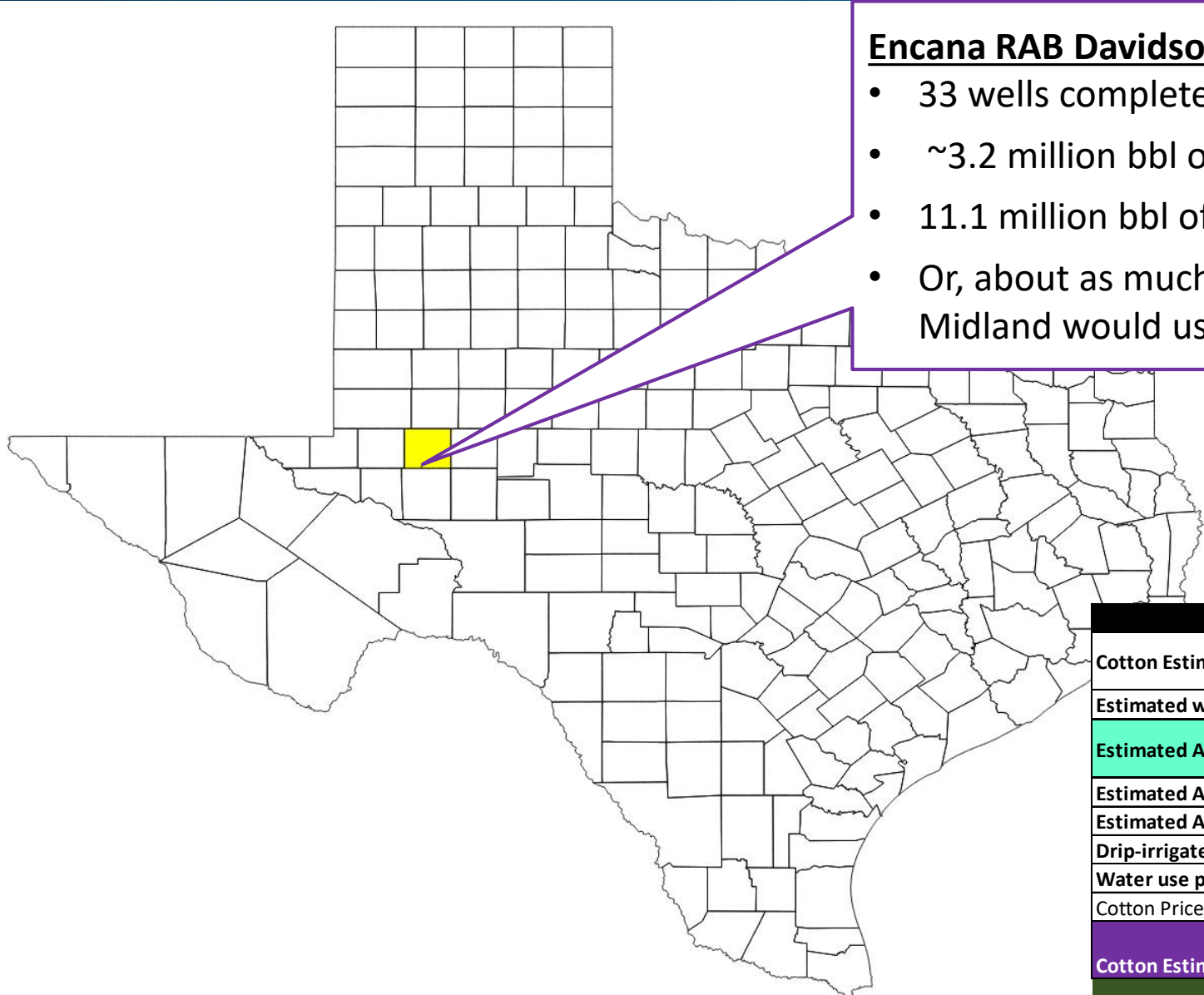
Water will likely account for approximately 80% of lifetime “mass moved” for many Permian Basin wells.

Source: CME Group, Empire State Realty Trust, FracFocus, TexasBrine.com

This analysis assumes 500,000 barrels of oil produced, with a water-to-oil ratio of 3:1. In many cases, wells will ultimately produce more oil and at a higher water cut.



Putting Oilfield Water Flows in Perspective: Fracs & Farms



Encana RAB Davidson Pad:

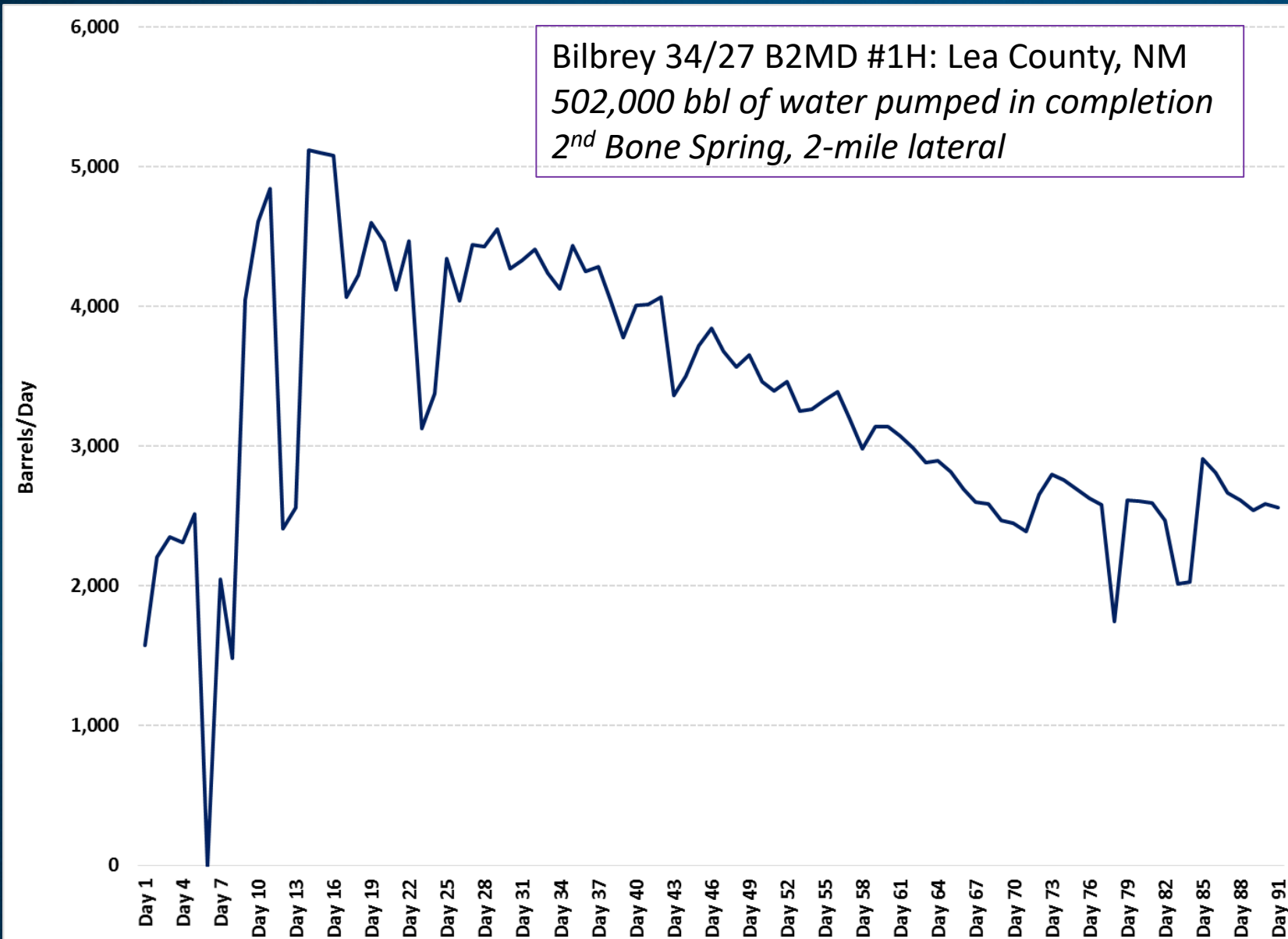
- 33 wells completed between April 2016 and April 2017
- ~3.2 million bbl of oil and 13.3 bcf of gas produced thru Jul-18
- 11.1 million bbl of water pumped
- Or, about as much water as 1,000 acres of cotton grown near Midland would use in a single season

Source: FracFocus, TX DOT, TX RRC

Cotton Estimated Irrigation Need (District 2)	18	ac-in
Estimated water system efficiency	95%	
Estimated Annual Water Needs of 1,000 acres of cotton, AF	1,579	
Estimated Annual Water Needs of 1,000 acres of cotton, barrels	12,249,474	
Estimated Annual Water Needs of 1,000 acres of cotton, gal	514,501,579	
Drip-irrigated cotton lint yield per acre, annual	1,500	lbs
Water use per lb of cotton lint	326	gallons
Cotton Price, USDA West Texas (2017)	\$0.74	per lb
Cotton Estimated Economic Output Per Gallon	\$0.002	

Source: TAMU Agricultural Extension (District 6 crop budgets), USDA

Putting Oilfield Water Flows in Perspective: Frac Flowback



Perspective:

- This well's peak flowback day would submerge the Doré Commons where we sit today under about 10 ft of water.
- This well's cumulative 90 day flowback volume could fill about 19 Olympic-size swimming pools (660k gallon pool size)
- Now scale this out for a pad drill project with 5, 7, or even 12 wells, with many of them flowing back simultaneously post-completion.
- The resulting water management challenges—from both the perspective of managing peak flow and that of just managing the sheer volume—are substantial.

What Might The Numbers Behind a Billion Dollar Oilfield Water Midstream Entity Look Like?

<i>Integrated System</i>		
Estimated water volumes to justify a billion USD enterprise valuation***		
EBITDA Multiple	Frac Sourcewater, Kbd	Produced Water Gathering, Kbd
5.0	240	600
6.5	185	462
7.5	160	400
10.0	120	300

In other words, approximately 550-to-650 thousand bpd of water.

In Fiscal Year 2017, the City of Midland's average combined daily water usage and sewage treatment volume was approximately 521 thousand bpd.

What Might The Numbers Behind a Billion Dollar Oilfield Water Midstream Entity Look Like?

Estimated water volumes to justify a billion USD enterprise valuation***

Produced Water-Only

475 kbd

(assume \$0.75/bbl rate)

@7.0X EBITDA multiple

Sourewater-Only

Texas-side:

1,500 kbd

(assume \$0.50/bbl gross price)

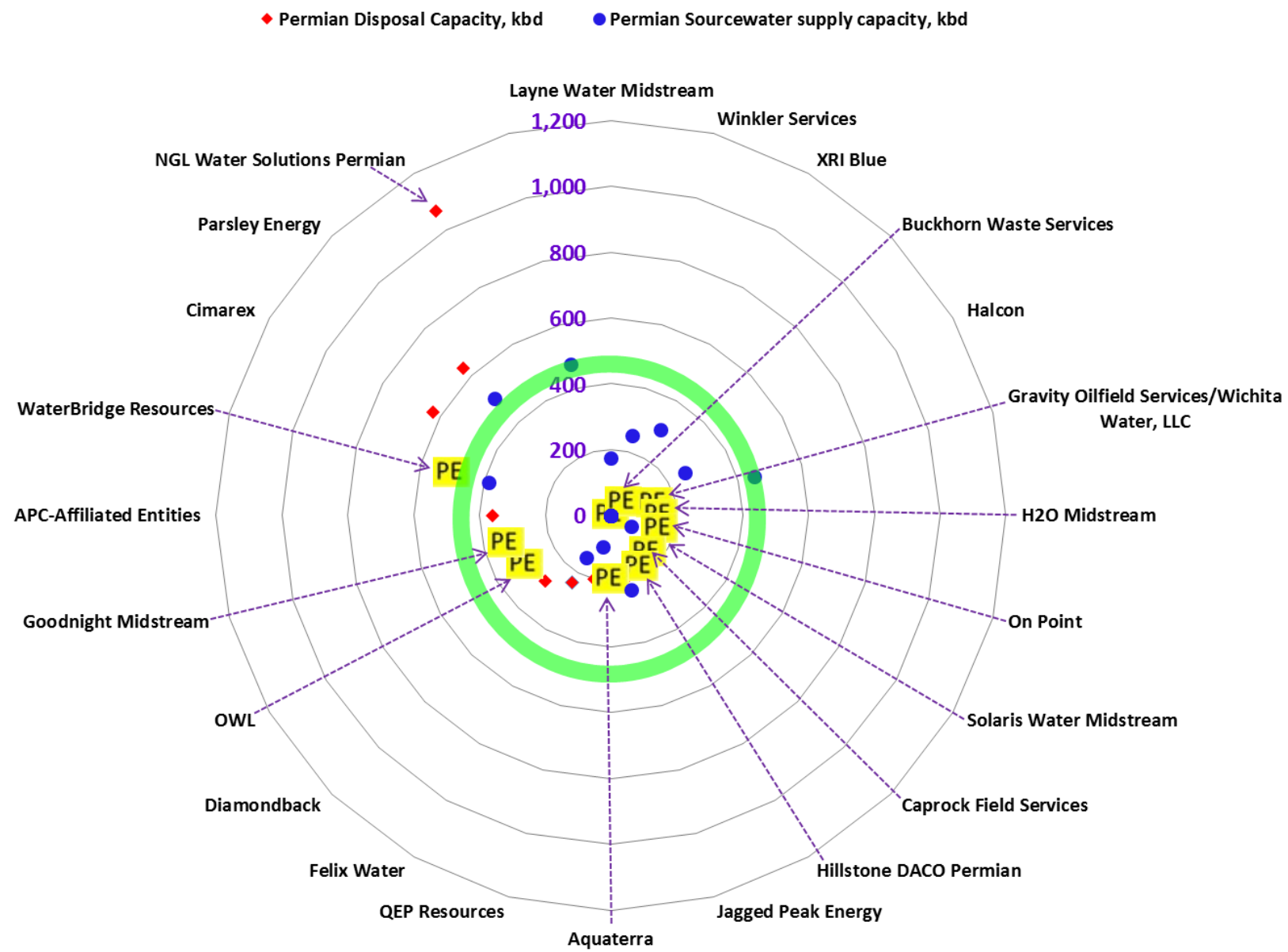
Premium sales into SE NM

425 kbd

(assume \$1.25/bbl gross price)

@ 5.5X EBITDA multiple

Permian Basin Oilfield Water Space Ripe for Consolidation and Organic Growth



If sponsors and management teams were so inclined, the simple math is that combining 2-3 of the yellow highlighted entities could create an entity that would have the nameplate capacity to handle enough water to potentially justify a billion dollar enterprise valuation.

Political, Regulatory, Operational, and Social License Factors

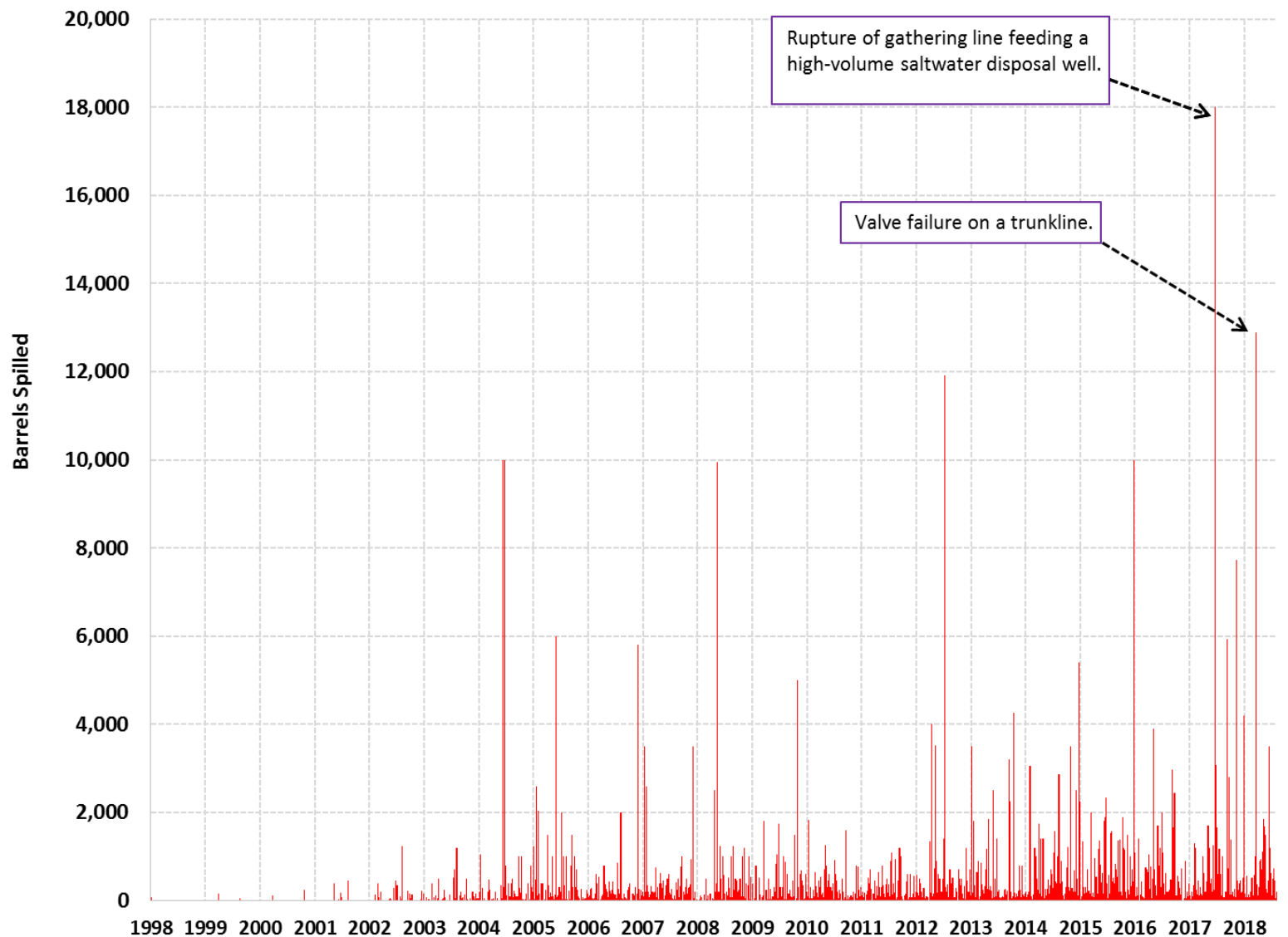
Road Damage and Dangers



Source: Axios, NPR, YouTube screen captures

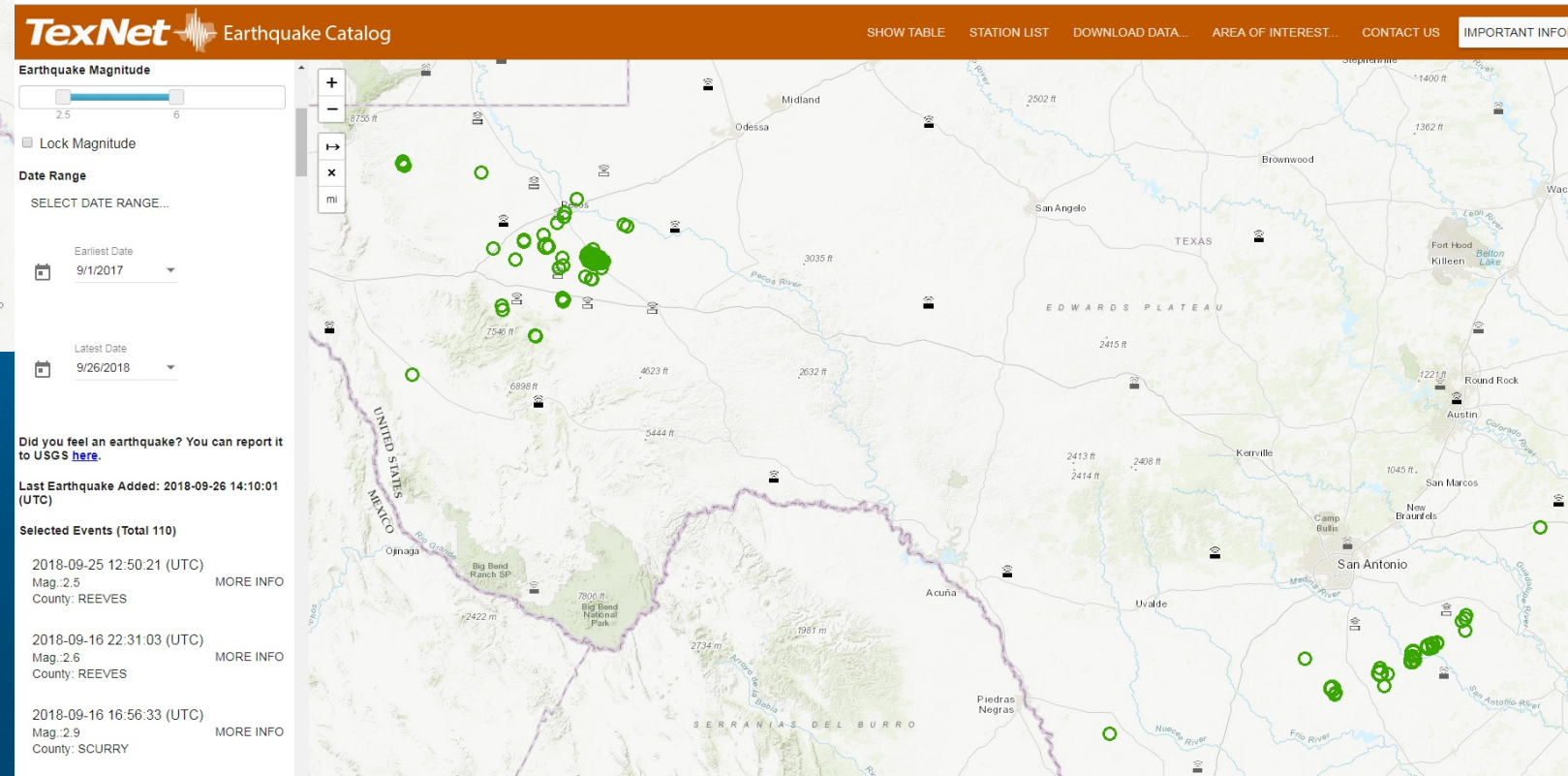
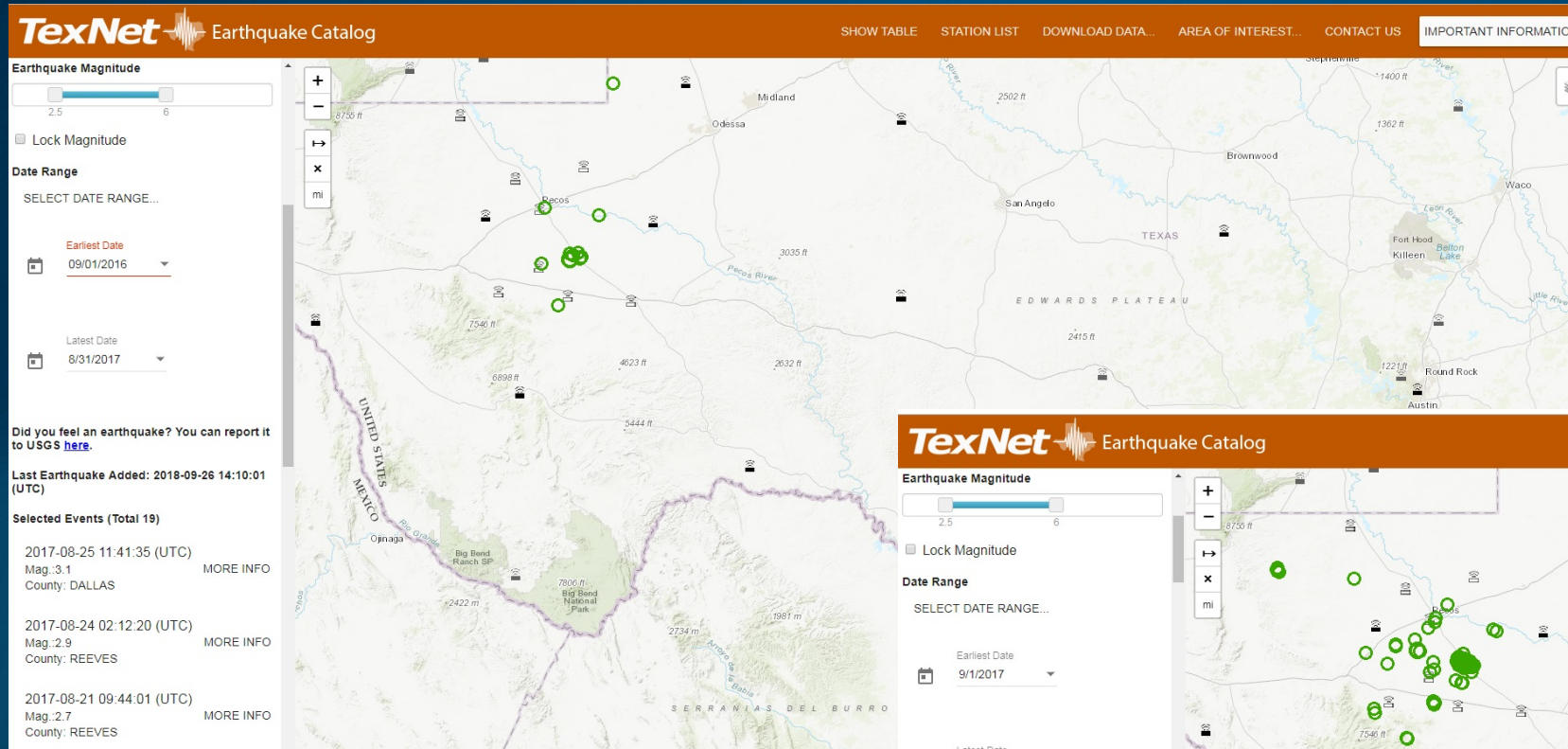
Water Release Concerns

New Mexico Permian Produced Water Spills (Barrels)



- ▶ The Texas RRC should consider systematically tracking produced water spills and making the data publicly available, as New Mexico and North Dakota do.
- ▶ Transparency drives better policy and better positions industry to respond proactively to potential challenges, rather than having a reactive solution imposed on it.

Seismicity Concerns



Operational Interference

May 2018

► At least two distinct problems:

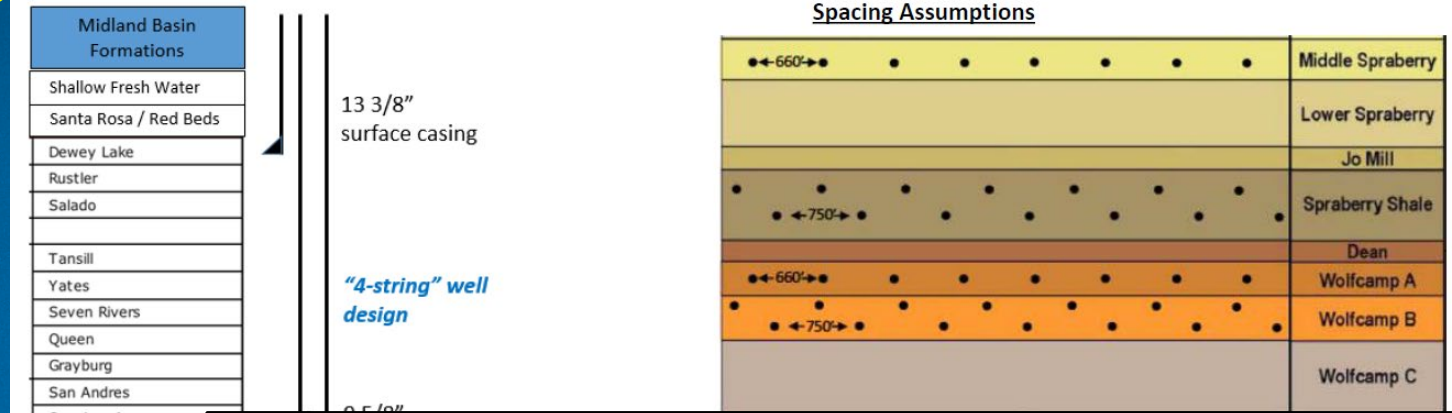
1. Drilling wells in areas with intermediate zones overpressured by water injection disposal costs significantly more

- ~\$600k per well in Midland Basin due to need for extra drilling liner, according to Guidon Energy
- If operators are targeting the Wolfcamp A, Wolfcamp B shale, and Wolfcamp B carbonate layers, this could translate to costs of about \$13 million for every 2 mi²
- This translates to about \$29 billion in potential incremental costs for the 6 core counties of the Midland Basin.

2. In some cases, shallow injection disposal appears to have “watered out” existing oil & gas wells.

- This may prove a sizeable—and thus far, underappreciated—problem in the Delaware Basin

San Andres Pressure Costs \$13 Million Every 2 Square Miles

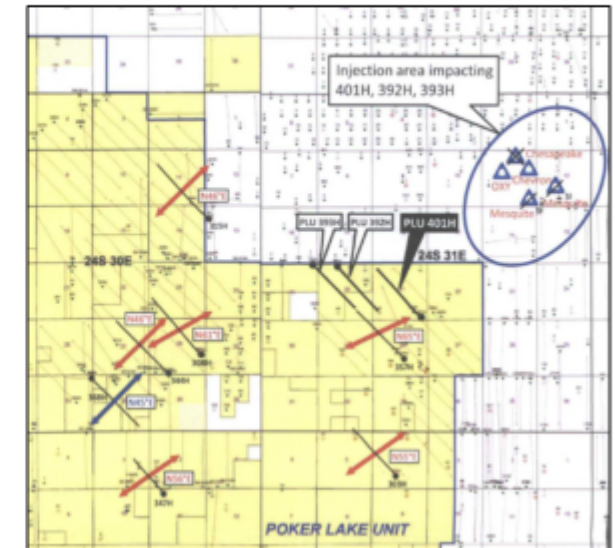


Recent Developments in Disposal Activities in Southeast New Mexico

• Delaware Mountain Group

With the expanded use of the Delaware Mountain Group for disposal by operators, there was an increase in reports of “waterflows” and abnormally high reservoir pressures observed in these formations in the vicinity of injection operations. Most notable of these events resulted in a Division case where an adjacent operator identified producing horizontal wells in the lower Brushy Canyon Formation that were impacted by injection in the upper formations of the Delaware Mountain Group.

This interference of production was attributed not to a single well, but to the concentration of several disposal wells with injection intervals within the Delaware.



June 2018

Cross-Border Water Arbitrage between TX and NM

Where politicians see theft...

“Texas is stealing New Mexico’s water...If you put a whole bunch of straws in Texas and you don’t have any straws in New Mexico, you’re sucking all the water from under New Mexico out in Texas and then selling it back to New Mexico.” --Aubrey Dunn, New Mexico State Land Commissioner (June 2018)



Source: Texas Tribune

Businesspeople see opportunity...

Solaris Water Midstream Acquires New Mexico Water Supply Business from Vision Resources, Inc. and Launches Major Expansion in the Delaware Basin

Jun 5, 2018, 9:30am EDT

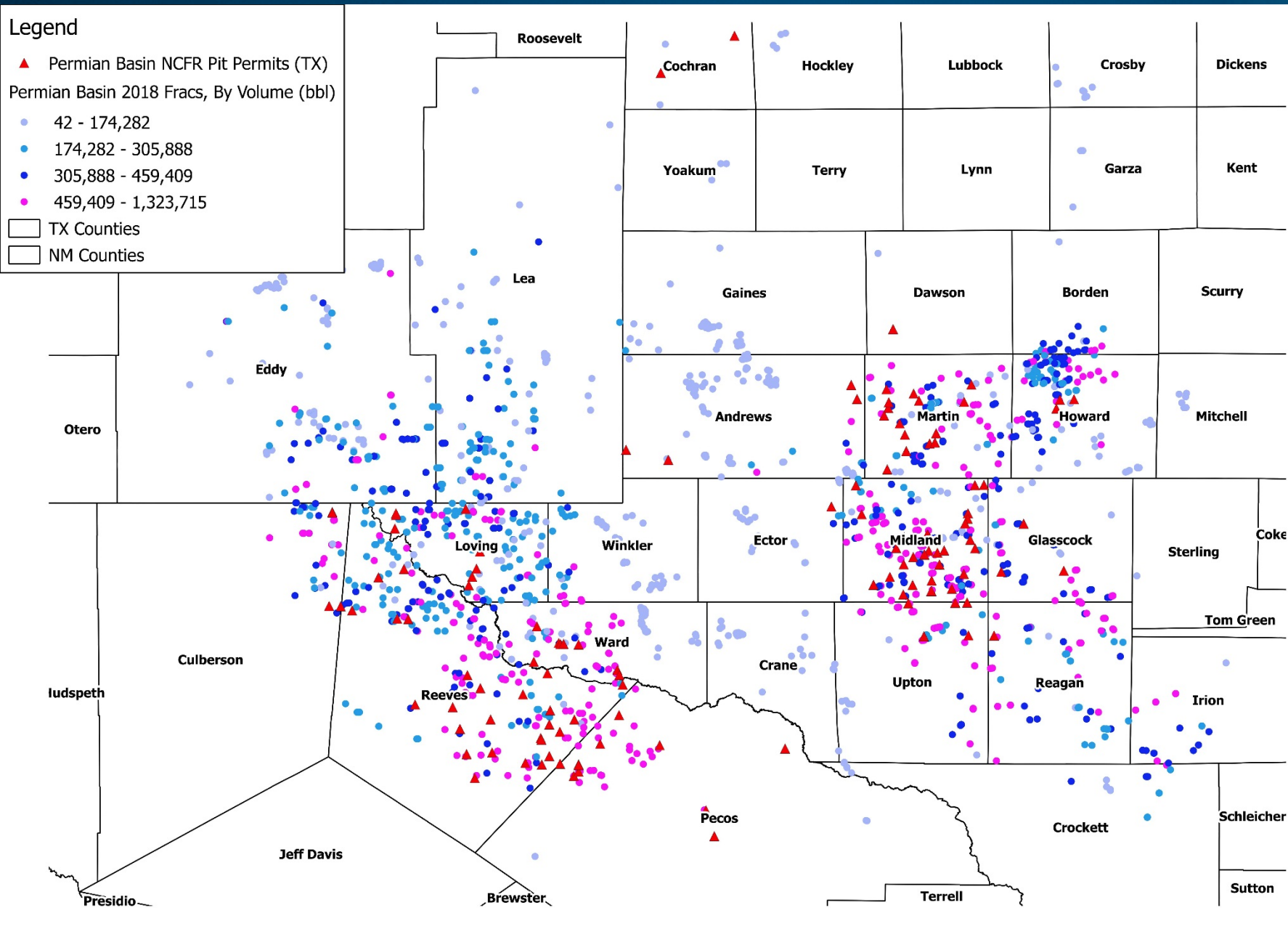
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Major Expansion to Pecos Star System

Solaris Water also announced that it has started construction of a new 11-mile water supply line that will connect into its Pecos Star System. The high-capacity pipeline will add crucial, permanent water supply infrastructure to one of the most prolific areas in the Permian Basin and will be capable of transporting approximately 150,000 barrels of water per day from Loving County, Texas, to Eddy County, New Mexico. Construction of this strategic pipeline is underway. The line is expected to come into service in July 2018.

Source: Dallas Business Journal

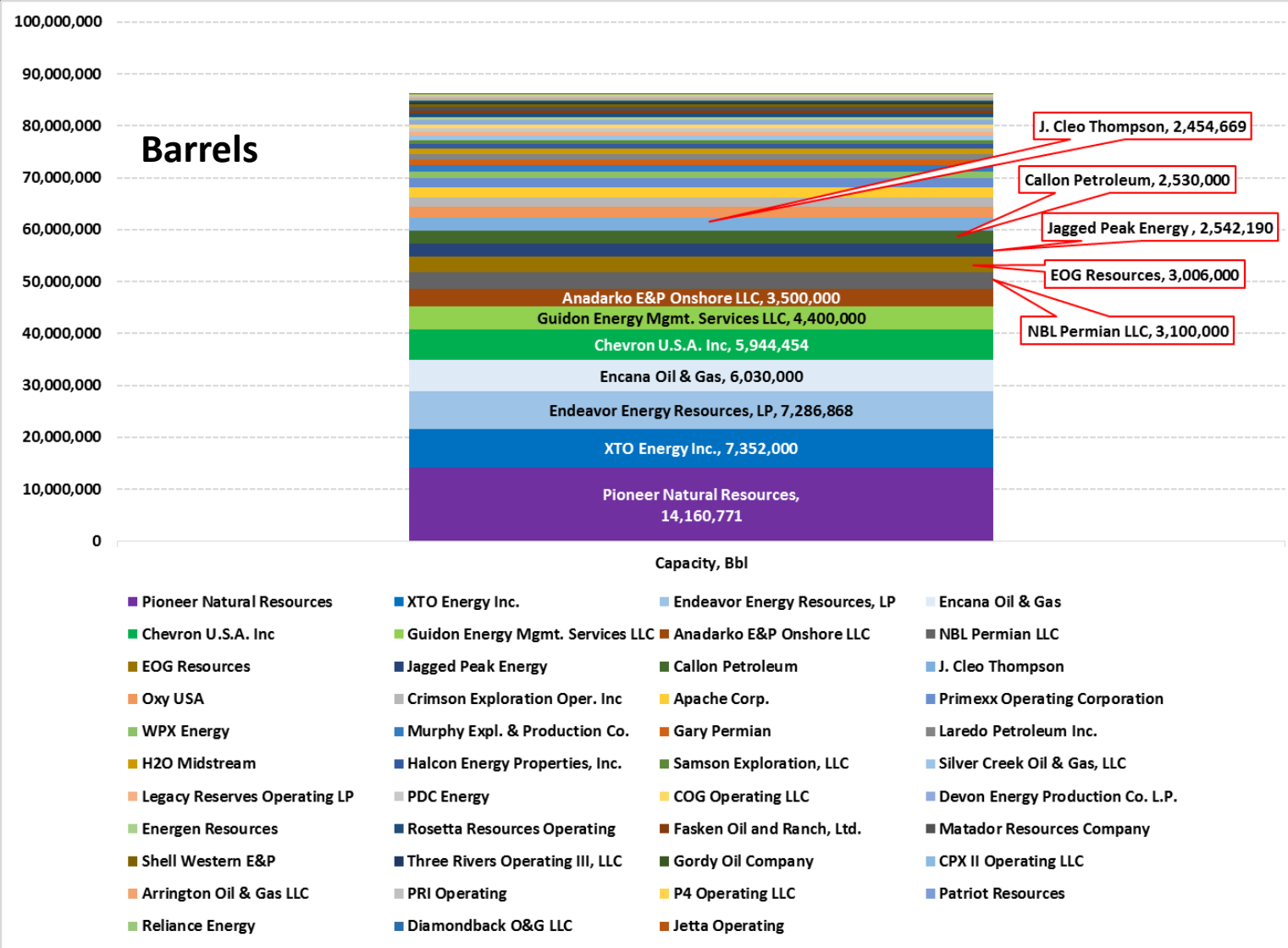
Oilfield Water: Frac Intensity & Recycling Infrastructure



- Nearly all of the these pits are non-commercial fluid recycling pits (“NCFR pits”) where the operators primarily treat produced water for reuse in their own operations.
- The only “commercial” pit I find to date is H2O Midstream’s Newton Facility in Howard County
- There are operational challenges to storing produced water, but increased interest in recycling activity suggests the number of commercial pits could rise sharply.
- This would be particularly true if produced water becomes a more widely-traded frac fluid feedstock.
- Trading of PW between parties is currently limited and generally on ad hoc basis.

Companies Are Gearing Up to Recycle More Produced Water

Non-Commercial Fluid Recycling Pit Capacity Companies Have Sought Texas RRC Approval For



Company-level Permian Recycling Plans

- ▶ **Apache**—“...by year-end, we feel like we'll be able to utilize about 80% of recycled water for our fracs [at *Alpine High*].” (2Q2018 Earnings Call)
- ▶ **Devon**—“~80% of total water used in operations is recycled” [*NM Delaware Basin*] (EnergyPlex Presentation, 2018)
- ▶ **Encana**—“We expect average 40% recycled water use in the basin with some cubes as high as 80%...” (2Q2018 Earnings Call)
- ▶ **Guidon Energy**—“Once infrastructure was built, we began using 13/87 produced/fresh mix for all fracs.” (May 2018 Presentation)
- ▶ **Noble**—“And by the end of the year [2018], I'd expect over 30% of the water used in our fracs to be recycled produced water.” (2Q2018 Earnings Call)
- ▶ **Pioneer Natural Resources**—“Right now, we're increasing our reuse volumes of our produced water to the point where it's going to represent 15% to 20% of our water volumes in the fourth quarter this year.” (2Q2018 Earnings Call)

A Few Permian Oilfield Water Predictions

A. **Within 12 months from today (start date August 2018)**

- ▶ A major Permian-focused water midstream firm goes public or has a similarly large liquidity event
- ▶ At least 3 additional large private equity companies enter the space
- ▶ At least 3 sizeable (80 kbd+ avg. actual volume handled) water midstream firms in the Permian will be acquired by a larger player

B. **Within the next 24 months**

- ▶ There will have been a billion-dollar oilfield water transaction in the Permian
- ▶ At least five Permian-focused entities other than Pioneer Water Management will be transporting and injecting 500 kbd or more of produced water

C. **Within the next 36 months (i.e. by August 2021)**

- ▶ At least 4 million bpd of incremental produced water (relative to August 2018) must be handled



If you have to eat crow...
...do it with grace and salt.

Source: Pinterest



Cutting-Edge Texas Groundwater and Oilfield Water Research

- Gabriel Collins, "*What Does it Take to Create a Billion Dollar Oilfield Water Midstream Company?*," PWS Permian Basin 2018 Symposium, 9 August 2018, Midland County Horseshoe Arena & Pavilion, https://texaswaterintelligence.files.wordpress.com/2018/08/collins_billion-dollar-oilfield-water-company_14-august-20181.pdf
- Gabriel Collins, "*Economic Valuation of Groundwater in Texas*," Texas Water Journal, Vol. 9, No.1, 2018 (50-68), <https://twj.media/economic-valuation-of-groundwater/>, (peer reviewed)
- Gabriel Collins, "*Groundwater Valuation in Texas: The Comparable Transactions Method*," Baker Institute Report no. 03.20.18, Baker Institute for Public Policy, Houston, Texas, <https://www.bakerinstitute.org/research/groundwater-valuations-texas/>
- Gabriel Collins, "*Valuation of Groundwater In Place at a Texas Frac Water Supplier*," Issue brief no. 12.07.17. Baker Institute for Public Policy, Houston, Texas, <https://www.bakerinstitute.org/research/valuation-groundwater-place-texas-frac-water-supplier/>
- Gabriel Collins, "*Oilfield Produced Water Ownership in Texas: Balancing Surface Owners' Rights and Mineral Owners' Commercial Objectives*," February 2017, Baker Institute for Public Policy, Houston, Texas, <https://www.bakerinstitute.org/media/files/files/23bd889f/CES-pub-ProdWaterTX-020817.pdf>
- Gabriel Collins and Hilmar Blumberg, "*Implementing three-dimensional groundwater management in a Texas groundwater conservation district*," Texas Water Journal, Vol. 7, No.1, 2016 (69-81), https://journals.tdl.org/twj/index.php/twj/article/view/7037/pdf_17 (peer reviewed)
- ▶ Gabriel Collins, "*Blue Gold: Commoditize Groundwater and Use Correlative Management to Balance City, Farm, and Frac Water Use in Texas*," 55 Nat. Resources J. 441 (2015). (peer reviewed)

Appendix

X-Factor: Will E&Ps Decide to Run Their Own Water Systems?

Midstream parties acknowledge the risk...

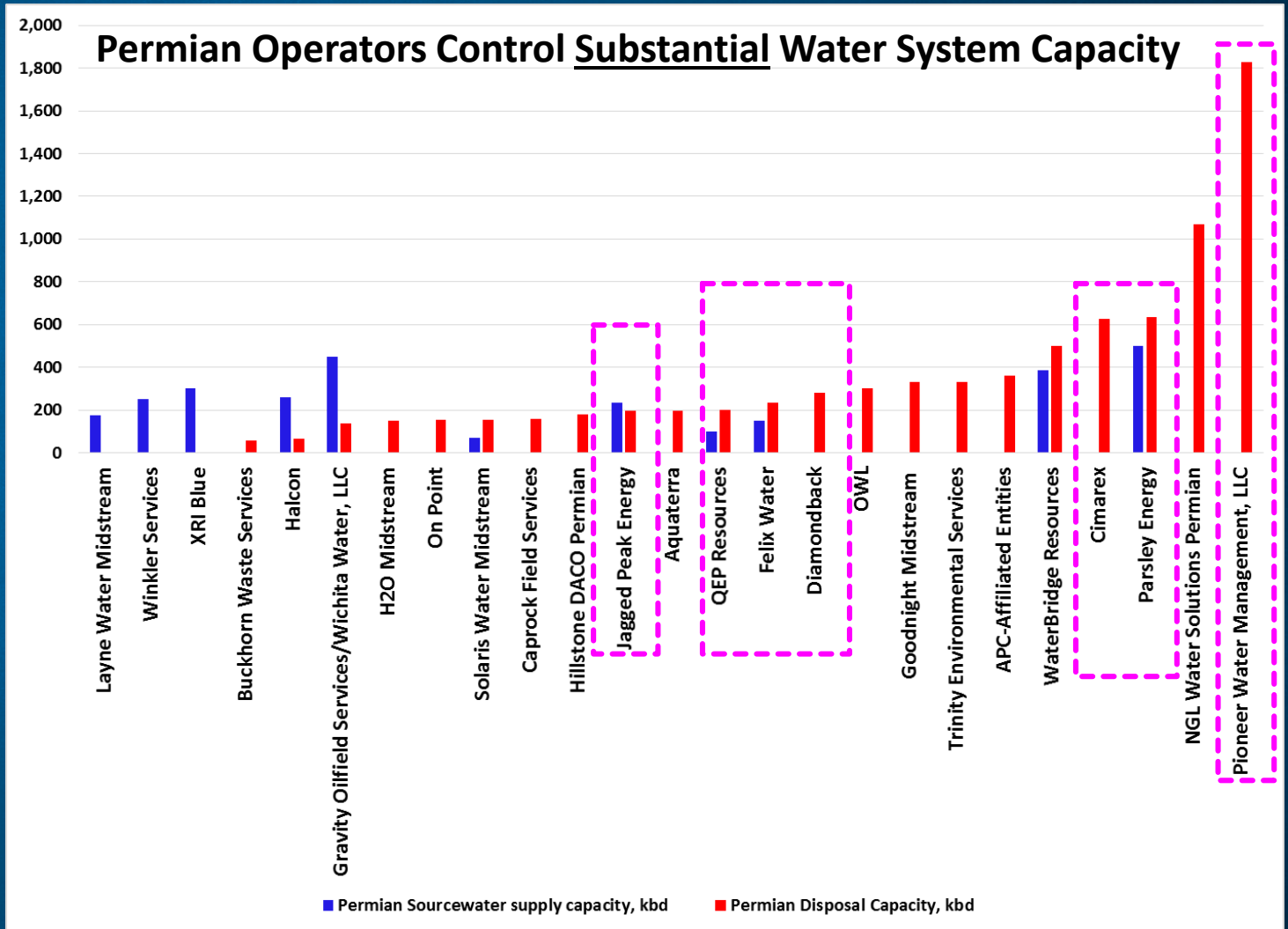
OMP, 2017 10-K, P.29

"...Potential third-party customers could decide to process and dispose of their produced and flowback water internally or develop their own midstream infrastructure systems for produced water and flowback water gathering and freshwater distribution..."

But do they really think it will happen?



Source: <https://diginomica.com/2014/08/12/rackspace/>



Source: Texas RRC, NM OCD, Company Reports, Author's Analysis